UML Profile for DoD and MoD Architecture Frameworks (UPDM)

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Problem Statement

- DODAF V1.0 Volume II provides guidance on using UML
  - Used extensively to represent DODAF architecture products across industry
  - Not sufficiently precise resulting in multiple interpretations (no one-to-one mapping between UML diagrams and DODAF products)
  - Based on UML 1.x which has been superseded by UML 2
- Tool interoperability impeded by DODAF adaptations, such as MODAF & NAF, and DODAF overlays, such as ICIDS and Acquisition

DODAF UML guidance is inadequate to facilitate communications, architecture product reuse & maintainability, and tool interoperability

Industry and Coalition Feedback

- Presented architecture framework standardization effort through the OMG in early February
- Resistance to immediate standardization of a UML profile for a generic Architecture Framework
  - Scope is too large to complete in a reasonable amount of time
  - Tool Vendors concerned about lack of market and technical risks
- Strong request for a UML profile that implements standard representations for DODAF/MODAF
- Support for follow-on effort to establish standards for the specification of generalized architecture frameworks
- Coalition partners and their industry partners requested that their requirements be included

Solution Statement

- DODAF V 1.0 exposed a need for architecture-based model-driven systems engineering

- SysML is a UML profile for model-driven systems engineering

- Initial analysis indicates good coverage of all DODAF/MODAF views with SysML*

Develop a UML Profile for DODAF/MODAF that provides an industry standard SysML representation of DODAF/MODAF architecture views

* see Bailey et al in references section

UML Profile for DODAF/MODAF RFP Scope

- Use DODAF V1.0 as a baseline
- Incorporate MODAF's additional views (Acquisition and Strategic views)
- Incorporate additional requirements from DODAF V2.0 WG (e.g., support for overlays)
- Support for modeling system-of-systems architectures
  - Systems that include hardware, software, data, personnel, procedures, and facilities (DOTMLPF & MOD Lines of Development)
  - Service oriented architectures and net-centricity
- Scope accommodates NATO and other architecture frameworks (e.g., Australia and Canada)

UPDM RFP Status

- RFP has been issued by OMG
  - Several comment iterations
    - January-Feb, June, Aug 05
    - A result of collaboration with DoD and MOD representatives
- Incorporates numerous inputs from
  - **Tool Vendors**: Adaptive, Artisan Software, Borland, I-Logix, IBM-Rational, Proforma Corp., Telelogic/Popkin Software
  - **Industry**: e.g., BAE Systems, Boeing, Fujitsu, Hitachi, Lockheed Martin, Raytheon, Thales, Unisys
  - **Gov**: DoD, MOD, NATO, and positive feedback from Canadian and Australian Defence
  - **Not-for-profit Organizations**: Sandia Labs, SEI, Mitre, Middlesex University

UPDM RFP
Requirements Summary

- Mandatory
  - Develop profile that specifies
    - Metamodel (abstract syntax and constraints)
    - UML2 Profile
    - Notation (concrete syntax)
    - DODAF and MODAF artifacts
    - Additional views and viewpoints
    - Element taxonomy reference
    - Data interchange
- Optional
  - Support
    - Domain Metamodel
    - Data Interchange mappings and transformations
    - Extensibility to other architecture frameworks
    - Representation of architectural patterns

Metamodel

- Defines:
  - Key terms and definitions used in the proposed profile
  - Concepts that are required for the description of architectures and consistent with those defined in IEEE 1471 and specific architecture frameworks (e.g., DODAF, MODAF)
  - Constraints on elements that ensure connectivity and integrity of the model

SV-1 Meta-Model Excerpt*

Source: http://www.modaf.com/
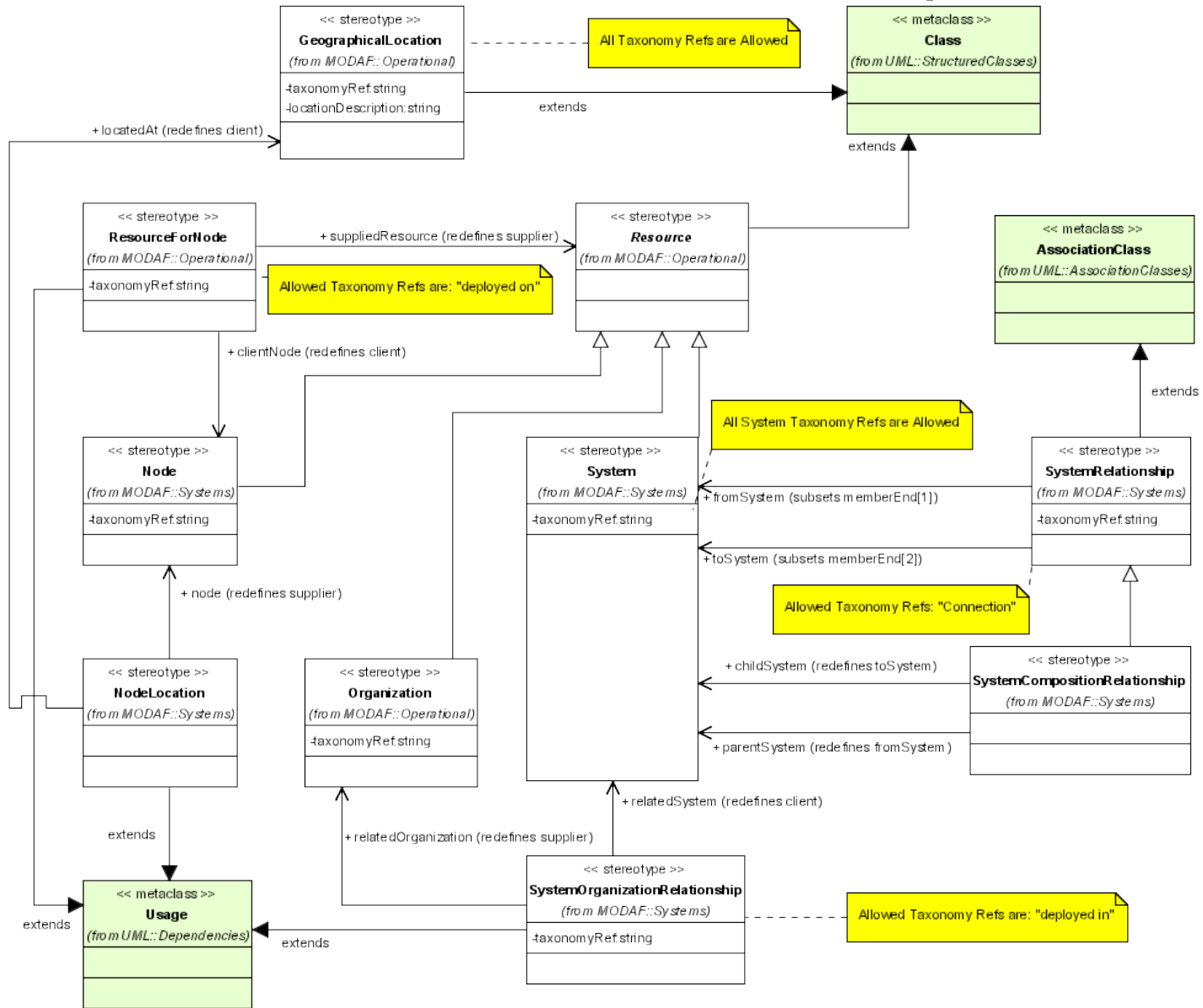
Notation & Profile

- Define:
  - The selected UML modeling elements using a standard notation
  - Their stereotypes
  - Additional constraints using the profiling mechanism provided by UML
  - The relationship of notation to model elements defined by the metamodel shall be represented in tabular form

Example SV-1: Assembly Diagram
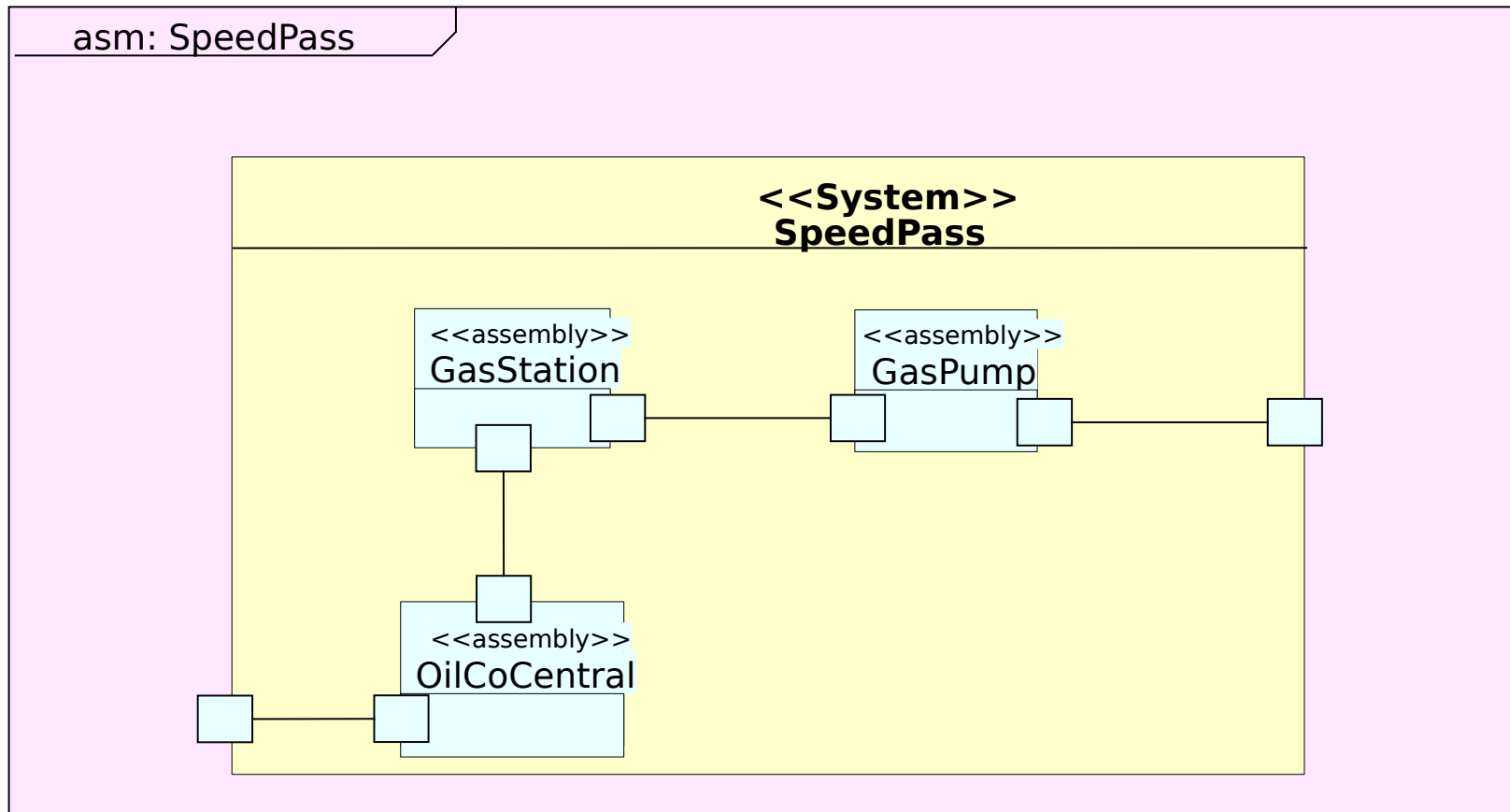
**Systems Nodes showing System Interfaces (Interfaces and Ports)**

Views & Viewpoints

- DODAF/MODAF artifacts using UML/SysML

- New model elements using MOF QVT, when no direct diagrammatic representation is provided for individual DODAF and MODAF artifacts in UML/SysML

AcV-2 SoS Acquisition Programmes

new

Acquisition Views define the project team structures required to deliver network enabled capabilities. They also define the inter-project dependencies and specify the lines of development status at
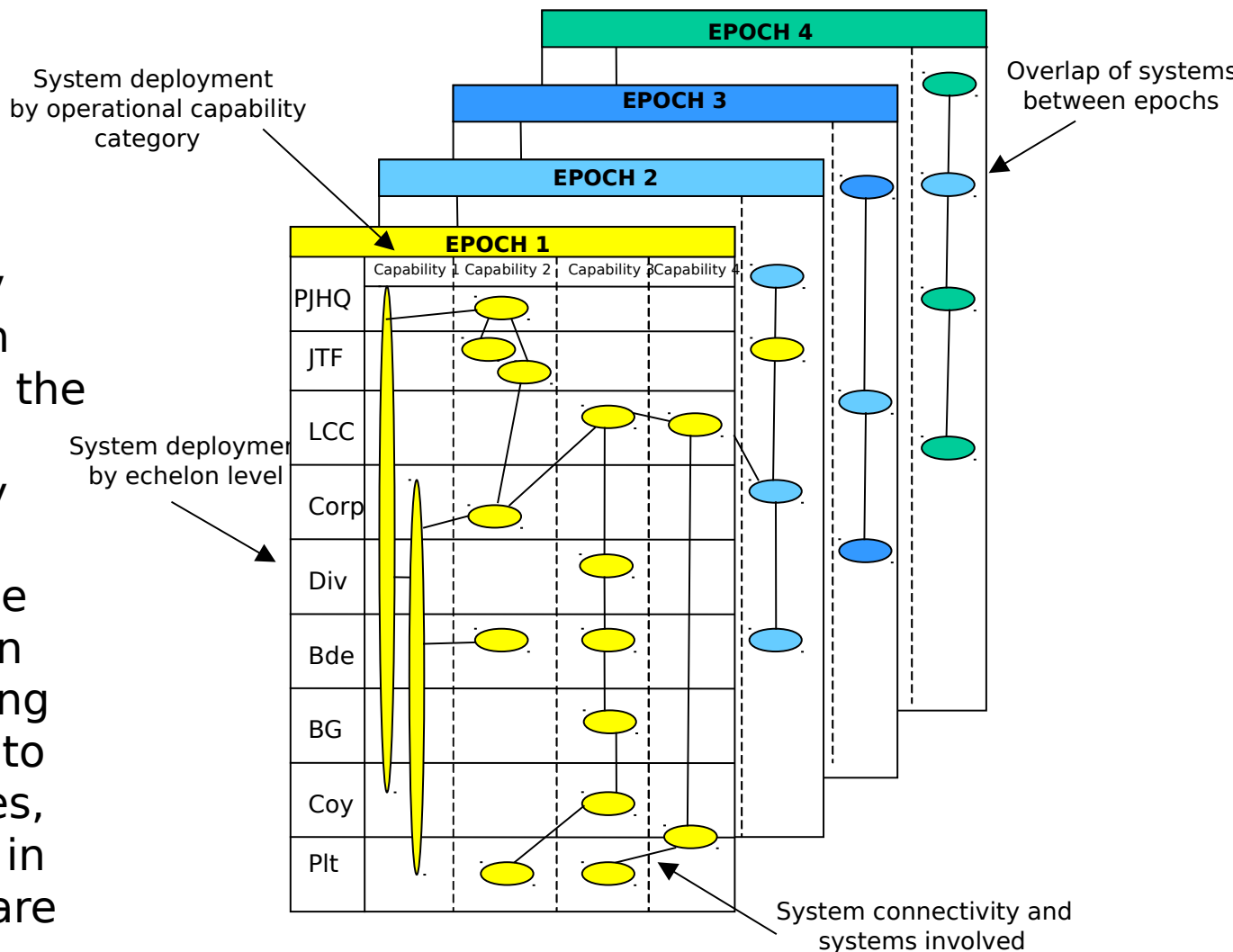

Source: http://www.modaf.com/

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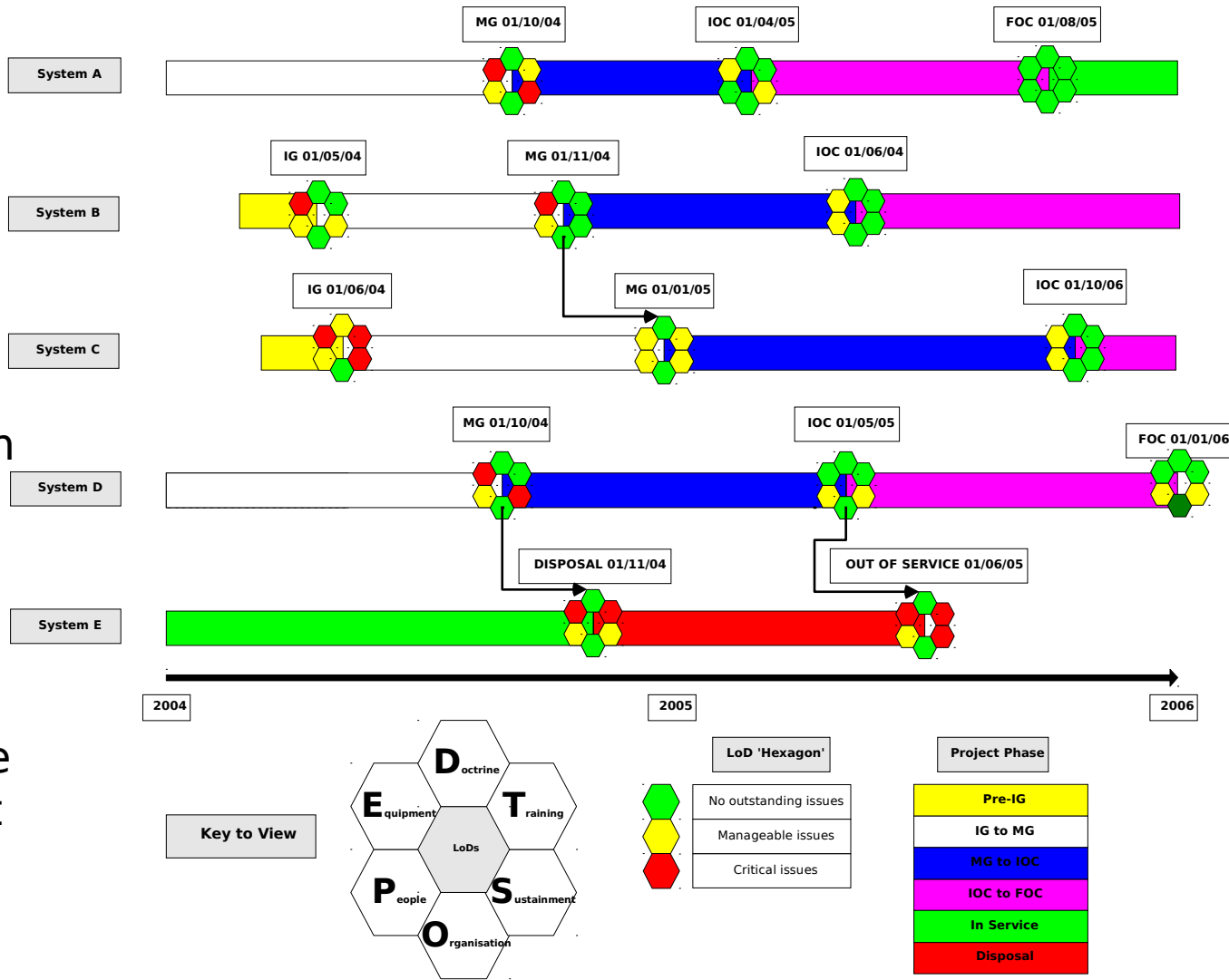
StV-5 Capability to Systems Deployment Mapping

new

Strategic Capability Views define the high level capability vision, the capabilities and sub-capabilities (capability functions) required to support that vision, the dependencies between capabilities, the phasing in and out of systems to support the capabilities, and the organizations in which those systems are to be deployed.

Source: http://www.modaf.com/

System deployment by operational capability category

EPOCH 4

EPOCH 3

EPOCH 2

EPOCH 1

Overlap of systems between epochs

	Capability 1	Capability 2	Capability 3	Capability 4
PJHQ				
JTF				
LCC				
Corp				
Div				
Bde				
BG				
Coy				
Plt				

System deployment by echelon level

System connectivity and systems involved
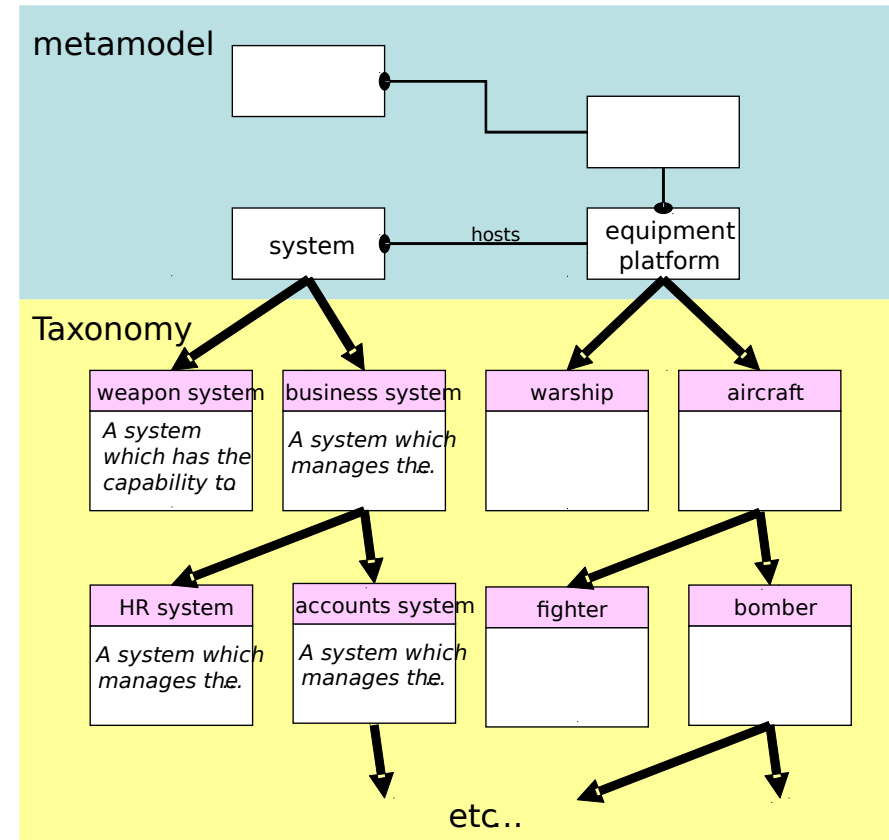
Example DODAF 2.0 New Viewpoints (Overlays)

- Acquisition – MODAF Acquisition Viewpoint

- JCIDS – MODAF Strategic Capability Viewpoint

- Portfolio Management

DODAF 2.0 Overlays

DODAF View		Enterprise Architecture			CJCS 3170 JCIDS Requirements	CJCS 6212 NSS and IT Systems	DoD 5000 Federal Acquisition	Federal Enterprise Architecture	GIG Capstone Requirements Document
		Enterprise Arch	Program Arch	SoS Arch					
AV-1	Overview and Summary Information					X			
AV-2	Integrated Dictionary	x	x	x		X		X	
OV-1	High Level Operational Concept Graphic				ICD, CDD, CPD		X		
OV-2	Operational Node Connectivity Description				CDD, CPD	X	X	X	
OV-3	Operational Information Exchange Matrix	x	x	x	CDD, CPD	X	X	X	X
OV-4	Organizational Relationships Chart	x							
OV-5	Operational Activity Model	x	x	x	CDD	X		X	X
OV-6a	Operational Rules Model	x	x	x	CDD			X	X
OV-6b	Operational State Transition Description			x	CDD			X	
OV-6c	Operational Event-Trace Description			x	CDD, CPD	X	X	X	
OV-7	Logical Data Model	x	x	x				X	X
SV-1	Systems Interface Description		x	x	CDD, CPD		X		X
SV-2	Systems Communications Description			x	CDD, CPD			X	X
SV-3	Systems-Systems Matrix								
SV-4	Systems Functionality Description		x	x				X	X
SV-5	Operational Activity to Systems Function Traceability Matrix								
SV-6	Systems Data Exchange Matrix				CDD		X		
SV-7	Systems Performance Parameters Matrix			x					X
SV-8	Systems Evolution Description								
SV-9	Systems Technology Forecast								
SV-10a	Systems Rules Model		x	x				X	X
SV-10b	Systems State Transition Description			x				X	X
SV-10c	Systems Event-Trace Description			x				X	X
SV-11	Physical Schema			x				X	X
TV-1	Technical Standards Profile		x	x	CPD		X		
TV-2	Technical Standards Forecast								
EV-1	Metadata View	x	x	x					
EV-2	Strategic View	x	x						X
EV-3	Quality/Financial View	x	x						X

|	
Initial Capabilities Document (ICD)	Required
Capability Development Document (CDD)	May be Required
Capability Production Plan (CPP)	

Metamodel & Taxonomy-Relationship

- The metamodel defines Enterprise Architecture concepts
- The taxonomy supports the metamodel, specializing the model elements into more specific items
  - Acts as a dictionary of terminology
  - Allows the metamodel to be more generic

metamodel

system — hosts — equipment platform

Taxonomy

| weapon system | business system | warship | aircraft |

weapon system — *A system which has the capability to...*

business system — *A system which manages the...*

| HR system | accounts system | fighter | bomber |

HR system — *A system which manages the...*

accounts system — *A system which manages the...*

etc...

Distributed Taxonomies

- OWL is designed for the web:
  - Allowing references between OWL files at different locations (e.g. synonyms)
  - Allowing one OWL file to specialise definitions in other files
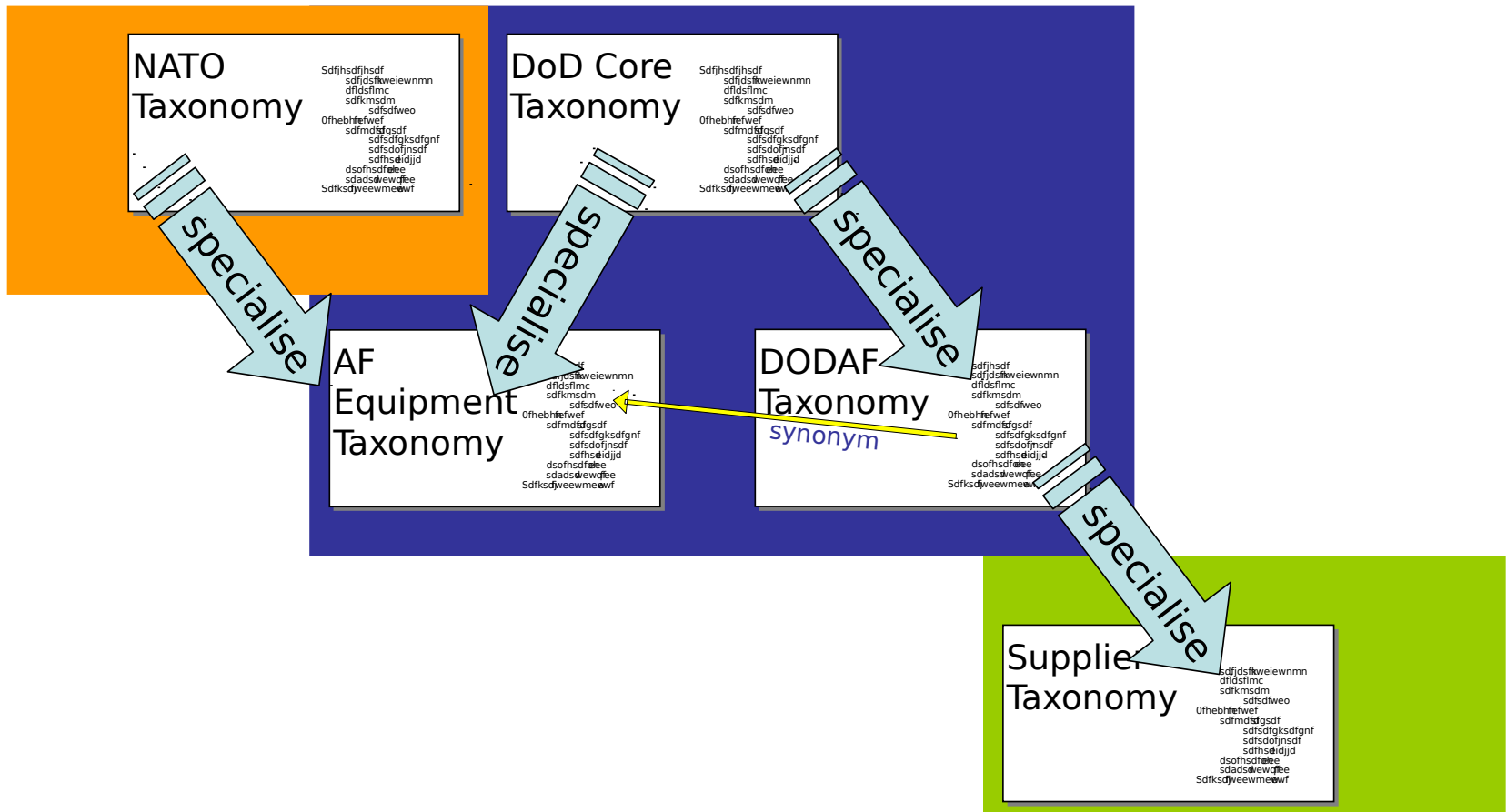
Data Exchange

- UML profile and meta-model enable XMI for architecture tool interoperability.
- Elements in the XMI exchange file may refer to relevant taxonomy definitions
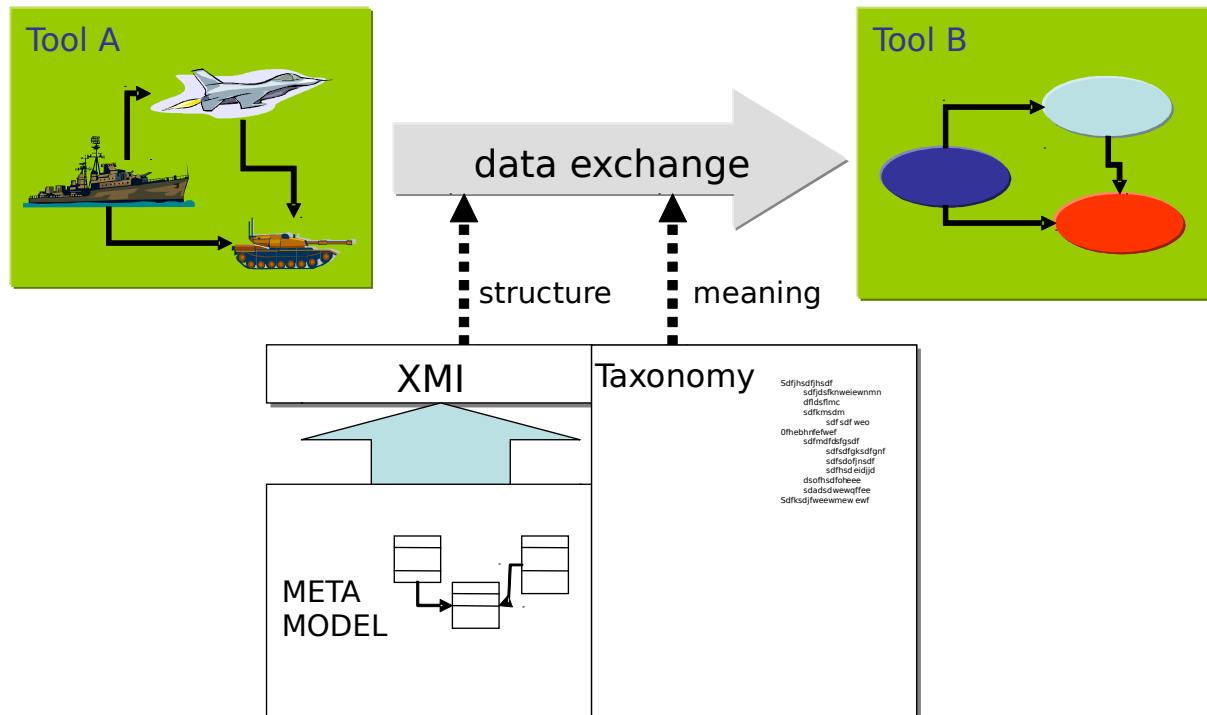
XMI for Data Exchange

- XML is an industry standard
  - XMI is XML for model interchange
- UPDM requires XML that conforms to a model
  - Make use of "vanilla" XMI with heavy use of stereotypes
  - Specified by extending the UML meta model
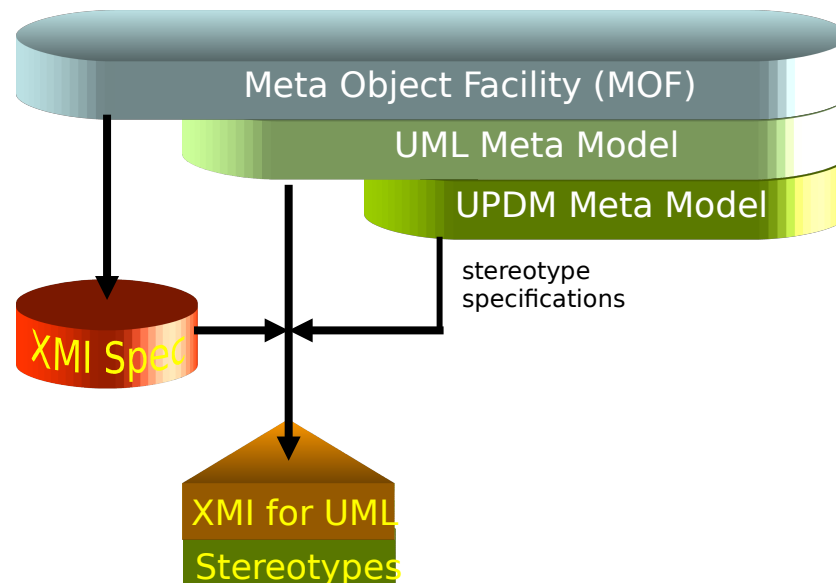
Generating the XML Schema

- For this to work, we need a common way of generating the XML schema from our model
- For this to work with XMI and XML, we need to use the XMI 2.1 XML schema production rules
  - …which means the meta-model has to be defined in UML…

OMG Specification Process & UPDM Timetable
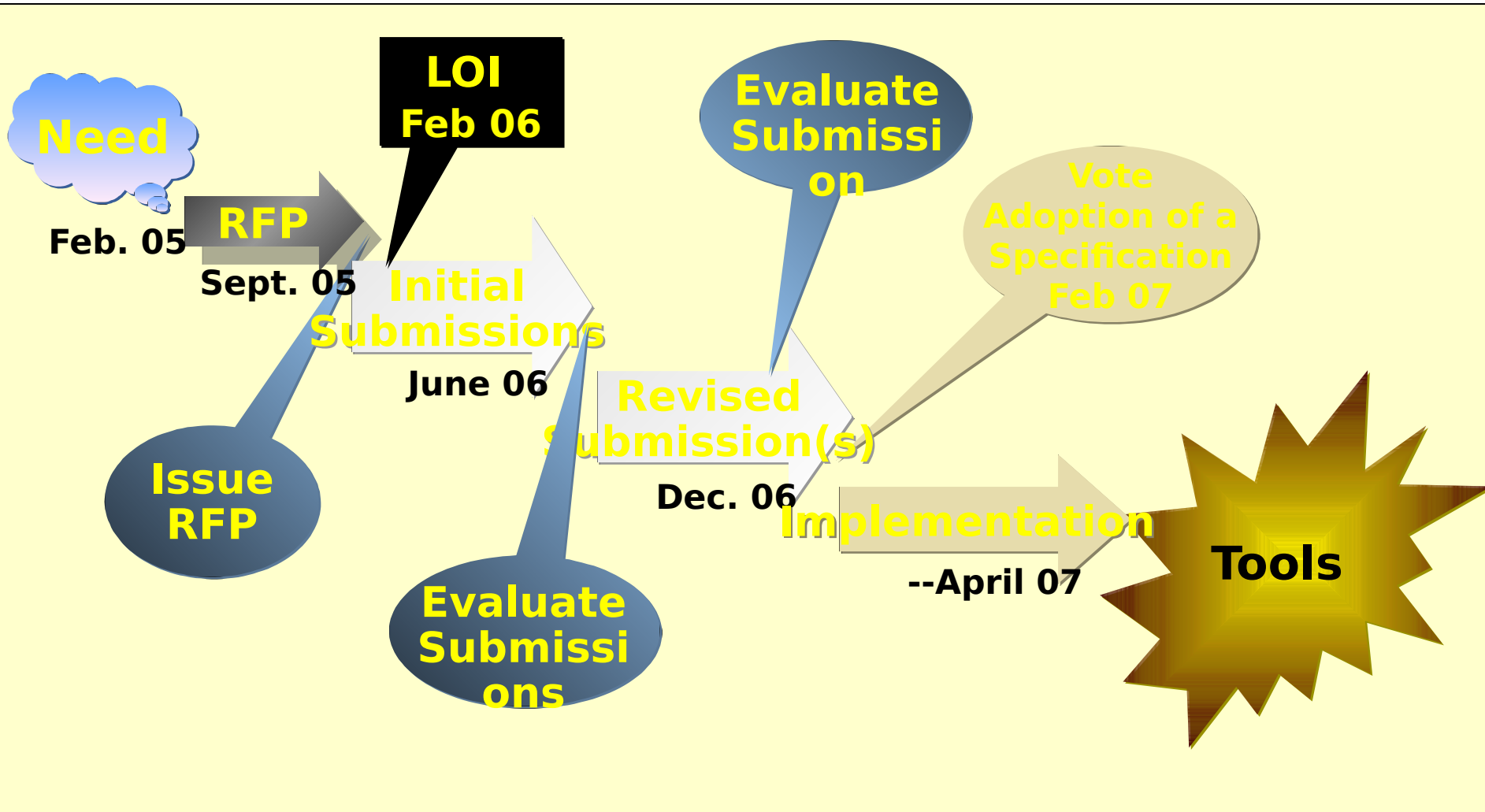
Relevant Standards

- Expectation for reuse of relevant existing OMG standards

- Referenced paper that contains analysis of OMG standards

- Referenced AP233 as a transformation mechanism from UML/XMI to DOD's CADM